U. S. DEPARTMENT OF AGRICULTURE.

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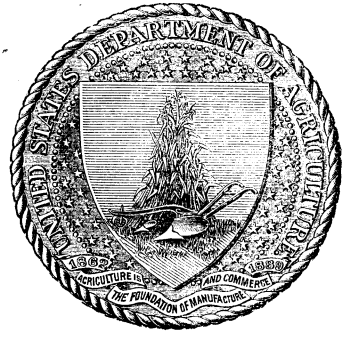
PEANUTS: CULTURE AND USES.

R. B. HANDY,
Of the Office of Experiment Stations.



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LETTER OF TRANSMITTAL.

U. S. DEPARTMENT OF AGRICULTURE,
OFFICE OF EXPERIMENT STATIONS,
Washington, D. C., December 15, 1894.

SIR: I have the honor to transmit herewith for publication as a Farmers' Bulletin an article on the culture and uses of peanuts, prepared under my direction by Mr. R. B. Handy, special agent assigned to this Office. Attention has recently been drawn to this crop because of attempts made to introduce peanut meal as an article of human food. It has also been urged that the manufacture of peanut oil in this country might be greatly extended. Present conditions do not, however, seem to warrant any considerable increase in the acreage of the crop. With this, as with other crops, the effort should rather be made to increase the average yield per acre by more careful cultivation and a proper rotation of crops. More attention should also be given to the utilization of the nutritive forage which the peanut plant affords. It is probable that in many localities peanuts might be profitably introduced and grown on a small scale as part of a diversified system of agriculture, with special reference to the use of the vines as food for farm animals. In the present bulletin methods of culture are described and the composition of the different products is given, with explanations of the nature and extent of their use for various purposes.

Respectfully,

A. C. TRUE, *Director.*

HON. J. STERLING MORTON,
Secretary of Agriculture.

CONTENTS.

PEANUTS: CULTURE AND USES.

DESCRIPTION AND HISTORY.

The peanut (*Arachis hypogæa*), known also in different localities as the earthnut, groundnut, ground pea, goober, and pindar, is a trailing, straggling annual, growing from 1 to 2 feet high, with thick, angular, pale-green, hairy stems, and spreading branches, and has the peculiar habit of maturing its fruit underground. (Strictly speaking it is not a nut at all, and should more properly be called the ground pea.) Its blossom is at the end of a long pedicel-like calyx tube, the ovary being at the base. After the fall of the flower the peduncle, or "spike," elongates and bends downward, pushing several inches into the ground, where the ovary at its extremity begins to enlarge and develops into a pale yellowish, wrinkled, slightly curved pod, often contracted in the middle, containing from 1 to 3 seeds. Should the "spike" by accident not be enabled to thrust its point in the ground within a few hours after the fall of the flower it withers and dies. When fully grown the pods are from 1 to 2 inches long, of a dusky yellowish color, with a netted surface.

More or less abundantly scattered over the roots of the peanut plant, as well as those of other members of the same family, are warts of about the size of a pin head, or larger (see Fig. 1, p. 7). These tubercles, as they are usually called, play a very important part in the life history of the plant. Within them, while in a fresh or growing state, may be seen, by the aid of a good microscope, myriads of very minute organisms. These bacteria-like bodies live partly on the substance supplied from the roots, and at the same time they take from the air and elaborate for the use of the plant considerable quantities of nitrogen. Nitrogen is the most expensive element that must be supplied to plants in fertilizers. The organisms living in these porous tubercles take it abundantly from the air, of which it comprises about five-sixths, and supply it to the plant without any cost. In this way a total amount of nitrogen is often acquired by the plant far in excess of the amount analyses show to be present and available in the soil. For this reason were the peanut cultivated as a green crop and turned under in the ground (like clover and cowpeas—species of the same

family) it would improve the soil rather than exhaust its fertility, as under the present method of culture.

Like many other extensively cultivated plants, the peanut has not been found in a truly wild state, and hence it is difficult to fix upon its habitat. So widely has it been cultivated in eastern countries that some botanists have attempted to trace its spread from China to Japan, thence through the East India Islands to India, and thence to Africa, where in the seventeenth century it was so extensively cultivated and had become such an important article of native food that the slave dealers loaded their vessels with it, using it as food for their cargoes of captives. But the weight of authority seems to be in favor of accepting it as a native of Brazil, thus adding the peanut to the four other plants of commercial importance that America has contributed to the agriculture of the world, namely, cotton, Indian corn, potato, and tobacco. Though it may be a native of the Western Continent, it early became a largely cultivated plant in the warmer portions of the Old World, occupying a distinct place in the agriculture of those countries long before its merits were recognized in the land of its origin.

While the peanut has been cultivated in the United States to a limited extent for a number of years, it is only since 1866 that the crop has become of primary importance in the eastern section of this country, which seems peculiarly adapted to its production.

Between 1865 and 1870 the rapid spread of the culture of peanuts was phenomenal, due probably to the knowledge of them acquired by the individual members of the various armies which at one time or another occupied the eastern section of Virginia. Each year doubled and at times increased threefold its crop over that of the preceding year, so that this country, from being a large importer of west African nuts, was soon able to supply the domestic demand with the home-raised article.

Virginia, North Carolina, and Tennessee produce a large part of the peanut crop of the United States. This is due, possibly, to the fact that their soil and climate are admirably adapted to the successful cultivation of this plant, and also, no doubt, because of the large profits which the farmer was able to secure from the culture of peanuts at a time when other agricultural industries were in a very depressed condition. Within the last few years this crop has ceased to be as profitable as heretofore. The method of culture—the annual planting of nuts on the same land, the lack of proper rotation of crops, the complete removal of all vegetation from the land, and the failure to replenish the soil by means of fertilizers—has been a great factor in reducing the profits of the crop by reducing the ability of the land to produce such crops as were previously secured in that section, so that now instead of an average of 50 bushels per acre, with frequent yields of over 100 bushels, the average in the peanut section is not over 20 bushels, while the cost of cultivation has been but slightly reduced.

COMPOSITION.

The composition of the different parts of the peanut plant, from the standpoint both of food and fertilizing value, is shown in the following tables, compiled from the most reliable data at hand. The results in the case of food constituents are calculated to a uniform water-free basis in order to admit of a fair comparison. It must be kept in mind that all of the substances in their original condition contained variable but considerable amounts of moisture, and if allowance is made for this moisture the percentages of the food constituents will be lower than those reported in the tables. The first column shows the percentages of moisture given in the original reports of analyses.

Food constituents in different parts of the peanut plant.

	Water.	In water-free substance.					
		Ash.	Protein.	Fiber.	Nitrogen-free extract.	Fat.	Nitrogen.
Peanut kernels:	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*
Alabama peanuts	10.88	4.26	35.37	2.66	19.33	55.37	5.50
Tennessee crop, 1888	3.87	2.40	28.65	2.37	17.23	49.35	4.58
Tennessee crop, 1889	4.86	2.51	27.07	2.52	19.30	48.60	4.33
Georgia peanuts	12.85	2.18	30.49	2.34	21.86	43.13	4.88
Spanish peanuts (grown in Georgia)	13.15	2.72	32.18	3.50	20.43	41.17	5.15
Egyptian peanuts	.....	2.85	22.97	1.61	20.27	52.30	3.67
Bombay peanuts	7.71	3.32	33.73	2.33	10.15	50.47	5.40
Congo peanuts	5.01	2.73	28.33	1.55	14.51	52.88	4.53
Rufisque peanuts (West African)	4.59	2.53	29.73	1.24	14.02	52.48	4.76
Japanese peanuts (Nankin-mame)	15.61	1.93	32.66	4.88	5.99	54.54	5.23
Japanese peanuts (Tojin-mame)	7.50	1.95	26.49	4.32	12.64	54.60	4.24
Average of all available analyses	7.85	2.77	29.47	4.29	14.27	49.20	4.67
Peanut vines (with leaves):							
Japanese, green	77.10	7.05	16.00	20.11	50.01	4.27	2.56
Spanish, cut before blooming	32.62	9.96	12.69	24.75	46.30	6.30	2.03
Georgia, cut before blooming	29.78	11.32	12.57	19.89	50.38	5.84	2.01
Average of last two	31.20	10.64	12.63	22.32	48.34	6.07	2.02
Spanish, cut when fruit was ripe	31.43	11.24	11.71	28.46	43.77	4.82	1.87
Georgia, cut when fruit was ripe	32.38	12.91	9.91	36.10	35.86	5.22	1.58
Average	31.91	12.08	10.81	32.28	39.81	5.02	1.73
Peanut hay, Tennessee crop	7.83	17.04	11.75	22.11	46.95	1.84	1.88
Peanut vines (without leaves), Egyptian	.....	8.80	6.25	32.95	49.49	2.50	1.00
Peanut leaves, Egyptian	.....	10.90	10.00	21.51	54.09	3.50	1.60
Peanut roots, Egyptian	.....	6.65	8.75	23.50	59.10	2.00	1.40
Peanut roots, Spanish (Georgia crop)	29.62	9.75	8.78	41.66	35.50	4.31	1.40
Peanut roots, Georgia	28.74	9.58	7.63	48.59	31.00	3.20	1.22
Peanut hulls:							
Spanish peanuts (grown in Georgia)	19.20	4.63	7.19	71.78	14.32	2.08	1.15
Georgia peanuts	20.62	3.00	4.99	79.30	10.59	2.12	0.80
Tennessee crop, 1888	8.81	2.03	6.42	73.07	17.14	1.34	1.03
Tenneesee crop, 1889	7.81	3.63	7.94	65.81	20.45	2.17	1.27
Coarse ground (German analysis)	10.50	3.13	7.71	69.37	16.22	3.57	1.22
Fine ground (German analysis)	10.70	3.58	8.18	66.64	17.90	3.70	1.31
Egyptian peanuts	.....	3.70	8.12	45.06	39.31	3.81	1.30
Average	12.94	3.39	7.22	67.29	19.42	2.68	1.17
Peanut shucks (inner coating of kernel)	10.80	5.72	25.11	20.96	26.89	21.52	4.00
Peanut meal (average of 2,785 analyses)	10.74	5.48	52.49	5.93	27.26	8.84	8.40

Fertilizing constituents in different parts of the peanut plant.

	In fresh or air-dry substance.					
	Water.	Nitrogen.	Phosphoric acid.	Potash.	Lime.	Total ash.
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
Peanut kernels	6.30	4.51	1.24	1.27	0.13	3.20
Peanut vines (cured)	7.83	1.76	0.29	0.98	2.08	15.70
Peanut hulls	10.60	1.14	0.17	0.95	0.81	3.00
Peanut cake (meal)	10.40	7.56	1.31	1.50	0.16	3.97

As regards food value these tables show that peanut kernels with an average of 29 per cent of protein, 49 per cent of fat, and 14 per cent of carbohydrates in the dry material take a high rank, and should be classed with such concentrated foods as soja beans, cotton seed, etc. The vines are shown to be superior to timothy hay as a feeding stuff, and but slightly inferior to clover hay. The food value of the hay is of course higher the greater the percentage of nuts left on the vines in harvesting. The hulls also appear to possess considerable value as a feeding stuff, being much richer in valuable food constituents (protein, fat, and carbohydrates) than cotton hulls, which are extensively used in some localities in the South as a coarse fodder, and about equal to the poorer grades of hay. The ground hulls are used to a considerable extent as a coarse fodder in European countries. Peanut meal (the ground residue from oil extraction) is a valuable feeding stuff, highly appreciated and extensively used in foreign countries. It contains, as the averages of over 2,000 analyses show, about 52 per cent of protein, 8 per cent of fat, and 27 per cent of carbohydrates, and is therefore one of the most concentrated feeding stuffs with which we are familiar, ranking with cotton-seed meal, linseed meal, etc., and in some cases ahead of them.

As regards fertilizing constituents, the tables show that the peanut, like other leguminous plants, is rich in nitrogen and contains considerable amounts of phosphoric acid and potash. The kernels are as rich in these constituents as the kernels of cotton seed and the vines are nearly as valuable as a fertilizer as those of cowpeas.

For the sake of completeness the fertilizing constituents of hulls and meal or cake are reported. It will be seen that the former are comparatively poor while the latter is quite rich, being nearly equal to cotton-seed meal as a fertilizer.

VARIETIES.

The Virginia running variety of the peanut, being most widely known and most popular with the trade, may be taken as the typical American peanut. Its vines are large, with spreading branches, growing flat on

the ground and bearing pods over almost their entire length. The pods are large and white, weighing about 22 pounds to the bushel.

The Virginia bunch variety grows erect and fruits near the taproot, but produces pods very closely resembling those above described.

There are two varieties in Tennessee, the white and red, the white closely resembling the Virginia running variety and the red producing somewhat smaller pods with kernels having a dark red skin. This variety matures earlier than the white, yields fewer pops, or imperfect pods, has a less spreading habit, and on account of this difference in growth is perhaps somewhat more easily cultivated.

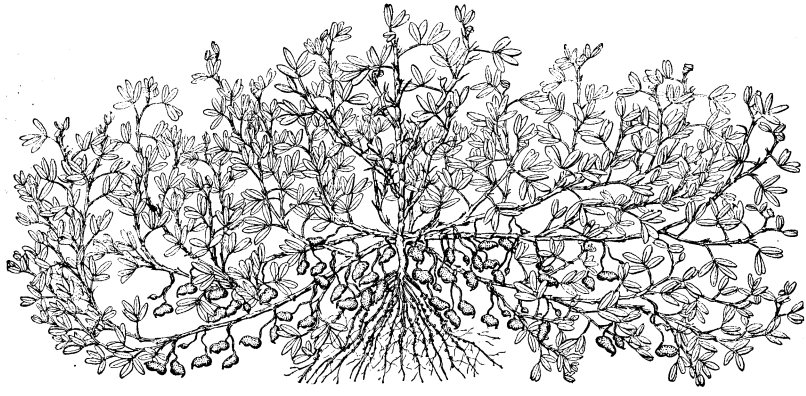

Fig. 1.—The Peanut plant (*Arachis hypogœa*)—Virginia running variety.

The North Carolina (or African) variety grown in the Wilmington section of the State has much smaller pods than those just described, weighing 28 pounds to the bushel, the kernels containing more oil than those of other varieties.

The Spanish variety has a relatively small, upright vine, forms small pods near the taproot, and can be planted much closer together than any of the others, thus producing a very heavy crop to the acre.

The North Louisiana Station found the Spanish a desirable variety, easily harvested, all of the peas adhering to the vine. It required a much shorter period to mature, and planted as late as July 1 matured a full crop in that latitude before frost. The pods filled out well, forming few if any pops.

The Georgia red nut, like the similar variety in Tennessee, has medium-sized vines growing up from the ground and fruiting principally near the taproot, with three or four kernels to the pod.

These comprise all the varieties cultivated in this country, but in Costa Rica there is a variety with long pods without division, containing four or five seeds, and in the Argentine Republic a large-sized variety with a deep orange-colored shell. In the Malay Archipelago there are two varieties, called the white and brown, resembling probably the white and red Tennessee varieties, except as to size.

The peanut of India and Africa resembles the North Carolina variety in size, and is raised principally for the oil which is contained in its kernels.

CLIMATE SUITABLE FOR PEANUT CULTURE.

While the peanut requires a climate in which there is a season of five months free from frost, it is not necessary that this should be a period of extreme heat, as the seeds form during cool weather in the latter part of summer and early autumn. (This fact has been developed by experiments with the crop during the past twenty-five or thirty years.) It was formerly supposed that being a native of intertropical countries and flourishing most luxuriantly in the warm, moist atmosphere of Brazil, India, and Africa, it would be impossible to successfully cultivate the peanut in the United States. Contrary to this view the attempt to cultivate it in North and South Carolina was successful, and step by step it extended northward until the fortieth parallel of latitude had been reached.

It is probable that on suitable soil the peanut will grow in any latitude where Indian corn will thrive, but whether it will be a profitable crop depends upon other considerations than its ability to withstand the climate. The most favorable weather for the peanut is an early spring, followed by a warm summer of even temperature, with moderate moisture and free from drought, and an autumn, or harvesting time, with very little precipitation, as rain injures the newly gathered vines and nuts. These climatic conditions are to be found on the Atlantic Seaboard from New Jersey southward, in the Mississippi Valley as far north as southern Wisconsin, and on the Pacific Coast south of the Columbia River. Again, it is probable that the quality of the nut depends upon climatic conditions, as it is true that the nuts grown in tropical countries contain much more oil than those of the same variety grown in temperate latitudes, so that the proposition has been laid down that the oil content of the nut is in inverse proportion to the distance from the equator. The nuts most in demand by the American trade are those raised between the parallels of 36° and 37½° north latitude, as they contain the least oil, therefore being better for use as human food.

SOIL SUITABLE FOR PEANUT CULTURE.

A sandy loam, neither too dry nor too sandy, yet light and porous, produces the most marketable peanuts, because it is nearer the natural color of the peanut shell, and the trade for which American peanuts are raised demands a light-colored shell, but equally sound and well-flavored nuts may be produced on other soils. In fact, almost any soil that can be put in a friable condition and kept so will produce peanuts, provided it contains a sufficient quantity of lime.

As cultivation of the crop extends, and more land is needed, much of this crop will be planted in clayey soil, and the result will be heavier peanuts. Indeed, more pounds per acre may be grown upon stiff land than upon light soil, the chief objection to dark and tenacious soils being that they stain the pods.

Clayey soil is somewhat colder and more inert, and the planting on such soil would therefore be somewhat delayed in the spring. In more northern latitudes, where the season is short, this might cause the crop to be cut off by frost before maturity. There is an abundance of good peanut land all along the Atlantic Seaboard from New Jersey to Florida, and also in the Mississippi Valley, not yet used for the crop.

MANURING.

It is not necessary that the soil on which peanuts are to be grown should be naturally calcareous, but if it is not it must be limed, the lime being necessary both for the proper fruiting of the plant and for its mechanical effect upon the soil. Much of the Virginia and North Carolina land has in times past been heavily marled, and there are parts of Tennessee and other States where there is already sufficient lime in the soil for the peanut plant.

Besides this addition of lime on soils where it is not naturally found, the peanut needs a dressing of potash and phosphoric acid. The potash is best supplied in the form of kainit, the phosphoric acid by fine-ground phosphatic slag. If the soil is heavy, instead of the slag a dressing of superphosphate may be used.

The lime and other dressing would be more effective if plowed under early in the season, but they may be spread down the furrow in which the seed is planted or applied as a top-dressing after planting. Any kind of lime may be used, provided it is finely comminuted by burning before application. Thoroughly burnt oyster shells, which are very accessible to farmers living along the Eastern Seaboard, common limestone, or marl will answer the purpose of the planter.

The quantity of lime or marl to use at one application depends very much on the nature of the soil and the amount of vegetable matter it contains. Generally 30 bushels of lime or from 100 to 150 bushels of marl are safe applications, but if the soil is quite thin and contains but little vegetable mold, more than this at one time would be attended with risk. A safer plan is to make several small annual applications of lime and also of vegetable matter (manure, compost, wood's earth, etc.), continuing this until a sufficient amount of lime has been applied. Land will bear large quantities of marl with perfect safety if kept well stocked with some vegetable matter to subdue its caustic effects. But most of the best peanut soil is deficient in humus, and the planter should begin cautiously, using small quantities of lime until he has supplied the other deficiency.

The amounts of fertilizing constituents required by a crop of 60 bushels of peanuts is shown in the following table, calculated from data reported by the Tennessee Experiment Station:

Fertilizing constituents required by a crop of 60 bushels of peanuts.

	Pounds per acre.			
	Nitrogen.	Phosphoric acid.	Potash.	Lime
Peanuts with hulls (60 bushels or 1,380 pounds per acre)	44.22	9.08	12.73	4.66
Peanut hay (2,000 pounds per acre)	40.49	5.72	19.57	41.64
Total crop (3,380 pounds per acre)	84.71	14.80	32.30	46.30

It does not follow that these figures show the exact proportion of nitrogen, phosphoric acid, and potash, which a fertilizer for peanuts should contain. They are useful only as guides in calculating formulas for a fertilizer for this crop, and must not be followed too closely.

In the formulas given below the amounts of phosphoric acid and potash correspond approximately with those given in the last table, but nitrogen is reduced to one-fourth for the reason that the application of nitrogenous manures to leguminous plants does not make any appreciable return for the outlay, since they are able to obtain a large part of their nitrogen from the atmosphere. Each of the mixtures contains about 21 pounds of nitrogen, 15 pounds of phosphoric acid, and 32 pounds of potash in available forms, and will be sufficient for one acre.

Fertilizer mixtures for peanuts.

FORMULA I.

Cotton-seed meal	300 pounds.
Cotton-hull ashes	130 pounds.

FORMULA II.

Acid phosphate	80 pounds.
Cotton-seed meal	300 pounds.
Kainit	240 pounds.

FORMULA III.

Barnyard manure	2 tons.
Cotton-seed meal	150 pounds.
Kainit	100 pounds.
Acid phosphate	50 pounds.

FORMULA IV.

Acid phosphate	100 pounds.
Dried blood	185 pounds.
Muriate of potash	65 pounds.

When phosphatic slag, which generally appears in the American market under the name of Odorless Phosphate, can be obtained it may be substituted with advantage for acid phosphate at the rate of 120 pounds in Formula II, 75 pounds in Formula III, and 150 pounds in Formula IV.

Few of the peanut planters pay sufficient attention to the rotation of their crops, but year after year plant peanuts in the same land, or at best change from peanuts to corn and then to peanuts again, with the result that the land rapidly deteriorates. Not only does the crop of nuts become smaller and smaller, but the vines, after a year or two of this treatment, lose their leaves before maturity, and thus the hay or forage part of the crop is practically lost.

When the land is kept in a good physical condition by the use of lime and proper culture, and a systematic rotation of crops is followed, it will not only retain its fertility and produce good crops for many years, but it will constantly increase its ability to produce peanuts in paying quantities. A good rotation is soja beans or cowpeas, to be followed the succeeding year by peanuts, and the next year by sweet potatoes; or the following one, that will keep the land well covered and is perhaps more convenient for the average peanut planter, is recommended: Peanuts followed in the fall by winter rye or oats and the next summer the land sown to crimson clover, to be followed the succeeding year by peanuts again, so that every other year peanuts will be the crop. The advantage of this would be an increased forage crop for the farmer—a much-needed addition in the peanut-raising sections of the United States—the covering of the land during nearly the whole year with a growing crop and the rotation of a cereal with a leguminous crop. Even in this system of rotation fertilizers should be used, until the soil is brought into good condition and no longer responds profitably to fertilizers.

It should be clearly understood that constant cropping without the use of proper rotations or manures must eventually impoverish both the soil and the planter.

CULTURE.

Preparation of the land.—There is no mystery connected with the culture of the peanut crop or any special secret knowledge as to the preparation of the land. Any modes of preparation that will reduce the soil to a finely pulverized seed bed, light and friable to the depth of 4 or 5 inches, will be safe to adopt. Peanuts being planted usually after corn, it is necessary to remove from the soil the butts of the corn-stalks, together with all other roots, clods, etc. The ordinary course followed by successful planters in various sections where peanuts are a prominent crop, is to break up the land with ordinary turn plow as soon in the spring as the soil is in condition to be worked, and then use a harrow and roller or smoothing board in such a way as to leave a level surface and seed bed, such as is above described, all roots, stumps, stones, and clods having been carefully removed.

Seed selection.—While there is among all planters a certain amount of selection of seeds for planting, more or less carefully done, according to the skill of the farmer and to the nature of the crop which he is about to plant, and in some cases extending to an elaborate and long-continued selection from the most prolific plants, yet in the case of peanuts, where good seed is of paramount importance, there seems to be but little more than ordinary care taken in the selection of seed—not more than in the saving of that portion of the crop which is to be sold on the market.

The seed should not only be carefully selected at the time of planting, carefully prepared so as not to break the skin of the kernel, and all immature, shriveled, or musty seeds rejected, but especial care should be exercised at the harvesting of the previous crop so that the seed may be of as great vitality as possible. The slightest frost upon the peanut vines either before digging or after they have been dug and before they become thoroughly dried will affect, to a greater or less degree, the vitality of the kernel. Overheating or mustiness is also detrimental to the kernel as a seed; consequently the seeds should be selected in the field before digging. They should be allowed to sun longer than peas intended for sale that they may be drier, and even should the pods lose color it does not matter, as the kernels will not be effected. They should be so stacked as to be kept very dry, and should be picked and allowed to dry thoroughly before being packed away for the winter. The best plan is to put them in bags in a cool, dry loft where they will neither heat nor collect moisture. Not more than two bushels should be placed in one sack, and great care should be taken to have the air circulate freely among them.

As it requires 2 bushels of nuts in the pod to give seed enough for an acre, and some farmers plant from 50 to 100 and even more acres, it is necessary to begin to shell the seed (nuts) several weeks before the time of planting. This requires some skill and care, both in opening the pod to avoid the breaking of the skin of the kernel and in selecting the sound and rejecting the imperfect kernels as they are shelled; and the seed thus shelled must be kept in a dry, cool, airy place until the time of planting.

Planting.—The time of planting depends upon the latitude, the distance from the sea, and the elevation of the section in which the seed is to be planted. In Virginia from May 1 to 20 is probably the time during which the larger part of the crop is planted, danger of killing frosts being past by that time, although some farmers plant the last week of April and others not until early in June. In more southern latitudes planting takes place in April, and farther north not before June. In no section should the seed be planted until all danger of the young plants being injured by a late frost is over.

As soon as the farmer has satisfied himself that the propitious time for planting has arrived, his land being in fine condition and his seed already prepared for planting, the question for him to decide is the distance between the hills which is best suited to the strength and fertility of his soil and to the variety of peanuts he intends to plant. As a part of this question he has to determine whether he will plant his seed in checks or in drills, both of which methods are in use in nearly every section where the peanut is grown. The advantages of one method over the other will depend upon the freedom of the soil from weed seed and upon the cost of labor. In checks, the cost of planting is probably greater than in drills, but if the ground is somewhat

full of weed seeds the cost of cultivation in checks would probably be less than in drills, because of the ability of the horse implements to more successfully keep down the weeds, as the field can be worked in both directions very close to the young plants, leaving but little for the hoe to do.

The distance between the drills or hills is, as above stated, dependent upon the variety to be planted and the fertility of the soil. In very fertile soil and with the running Virginia nut from 3 to 3½ feet square each way is the required distance between the hills, with 2 kernels to the hill; while with other varieties or on less fertile land the distance between the hills can be reduced, until on poor land with the Spanish nut the distance will be determined by convenience in using horse implements between the rows.

In drills, the causes stated above would affect the choice of distance, that most frequently chosen by the planter being 3 feet between the drills and 14 inches between the hills down the drill, 2 seeds to the hill.

In checking the land for peas a simple and inexpensive marker is in common use for the first marking out of the field. This consists of a piece of scantling 4 by 4 inches and 6 or more feet long, through which are inserted, at distances equal to the required distance between the hills, wooden pegs 2 by 3 inches and 18 inches long, shod at the ends with iron. To the main bar are attached a pair of shafts and handles to be used in drawing and guiding the implement. The cross marking is usually performed with a small turn plow, the droppers following it putting 2 seeds to the hill, covering them over with the hoe, or probably more commonly the foot, to the depth of 1½ or 2 inches, although some cover the seed with a small plow.

There is in use among peanut farmers a planter planned somewhat after the manner of a cotton-seed planter. It is drawn by one horse, and is fitted with a "shoe," at the base of which the kernels are dropped at distances from 8 to 20 inches apart, according as the machine is geared, and are covered by a concave wheel, which, passing over the furrow, presses the soil firmly down upon the seed.

Tillage.—The object of all plant cultivation is to keep the soil in proper condition for the growth of the plant. An important means to that end is the destruction of all weeds. Many crops are injured by the lack of cultivation, more by improper cultivation, and some undoubtedly by too frequent cultivation. The maxim that "the best cultivation is that given before a crop is planted, and the next best the one that is not given it" at the latter part of its growth, is perhaps as true of peanuts as of any other crop. If the farmer has prepared his land, having it porous, pulverized, and free from all weed seeds, there will be need of very little cultivation. It is not so much a matter of how many times the crop has been worked as in what condition the crop is at any given time that should determine the farmer in his management of it.

The implements of cultivation are the plow, harrow or cultivator, and hoe, all of which are used by some farmers, others dispensing with one or two of them. Where the peanuts are planted in checks, the larger part of the cultivation is done with the harrow or cultivator, while some cultivate peanuts, even when in drills, solely with the aid of the turn plow. Hoe work being very expensive, the farmer should strive to have his land in such condition as not to require much of it, and to so cultivate his crop in its early stages as to prevent the growth of grass, necessitating the use of the hoe.

One method of weed destruction, as practiced by a large number of peanut planters is, just before the plants are coming through the ground, say two weeks after they have been planted, to go over the field with a small turn plow, throwing the soil from both sides over the drill or hill, or where the seed was first covered with a plow, throwing the second furrow over them, and then "blocking off" these ridges with light wooden scrapers or "blocks," thus destroying the first weed crop with very little or no injury to the peanut plants. Another method is to bar off the soil from the vines, throwing it into the balk, and then a few days afterwards to send the harrow and hoes through the field, leveling the ridge in the balk and scraping off the narrow ridge between the plants, as in cotton culture. After this use a double shovel every ten days or two weeks until the field has been gone over five or six times. For the first two or three plowings the shovels may be run deep, and after that very shallow, each working being a little farther from the plant than the preceding one, to avoid disturbing runners. The pods are laid by the middle of July or the first of August, and the cultivation is finished by the latter date. After the peas begin to spread it is difficult to clean them, and therefore they should be thoroughly cleaned while they are young.

Two methods of peanut culture in vogue may be distinguished as the "level" and the "ridge" methods. In level cultivation the turn plow has no place, but the work is done almost entirely with the cultivator, the field when laid by presenting a flat appearance much resembling a clover field. In the ridge method the soil is, by use of either the cultivator or the turn plow, gradually worked from the balk to the vine, so that after the last working the peanut field very much resembles a sweet potato patch. Which of these two methods is of greater merit is perhaps not definitely decided, or indeed which may be more advantageous upon certain soils and with certain varieties, although the level cultivated field will probably stand drought better than the ridged.

The Nebraska Experiment Station made an experiment on this subject. Eleven rows were drilled 3 feet apart and seeded 10 inches apart down the row. Every other row was ridged and the bloom was covered, while the alternate rows were left level. The 5 ridged rows yielded at the rate of 2,944 pounds to the acre, the 5 level rows at the

rate of 5,368 pounds to the acre. This would seem to indicate level culture as best for the peanut, and certainly demonstrates that there is no need of following the old practice of covering the bloom of the plant. The eleventh row was planted with unshelled seed, ridged, the bloom covered, and yielded at the rate of 1,870 pounds.

HARVESTING.

The nuts should be out of the ground before the first frost, as it is injurious both to the vines, when regarded as fodder, and to the kernels. It may be necessary to dig the crop some time before frost is feared, because early formed nuts when frost is long delayed begin to sprout, and the loss to the farmer from that cause would be greater than the gain from the maturing of the later nuts. Besides, if peanuts have been cultivated in the same land for several years the vines often will drop their leaves and are thus greatly injured for use as hay.

Peanut farmers have a plow made especially for harvesting this crop, which has no moldboard and has a bar 3 feet long and an upright the same as the other plows. The foot piece is welded 12 inches from the rear end and extends up 5 inches, with a small hole through it, to which is fastened the hind helve of the plow. The beam is as usual, with handles fastened to either side of it. There is a duck bill on the flat end of the bar and a sword 4 inches wide and 16 inches long welded to the bar 5 inches behind the duck bill and extending out to the right side diagonally and backward, so as to run under and cut the taproot of the vine.

This plow, with two horses attached, is passed up each side of the row deep enough to escape the peas, the long wing cutting the taproots, rendering them easy to remove from the soil. Following this plow laborers with pitchforks remove the plants from the ground, carefully shaking off all loose soil, and piling then in windrows three rows in one. They are usually plowed in the morning, and then in the afternoon are stacked or shocked around poles 7 feet high, set in the ground at convenient places in the field. In shocking, care is taken to keep the vines from the ground, the usual practice being to lay a couple of fence logs on each side of the center pole, and the plants are so arranged around the pole as to have the pods inside, and also to leave some space next to the pole for the circulation of air. The shocks are usually capped with corn fodder or hay to keep out the rain.

After being thus stacked from fifteen to twenty days the pods are ready to be picked. This operation is usually performed by women and children, who are paid so much per bushel, and are expected to pick only the mature and sound pods. It is slow and tedious work, and one of the largest items of expense to the peanut farmer. Some farmers leave their nuts unpicked until spring, but this subjects them to the depredations of birds and animals, many of which readily eat either the nuts or the vines.

In the Wilmington section there is some variation from the above in the method of harvesting the crop. The vines after being allowed to remain in the ground two days after plowing are then pulled out and shaken free from soil and stacked around poles 12 to 14 feet high, where they are allowed to remain about a week or ten days and are then removed to large barns and stored away like clover hay until it is convenient for the planter to have his nuts picked. This peanut being much smaller than the Virginia or Tennessee nut and also more completely filling the shell, is not so easily injured as the larger varieties, and thus can be picked by machinery of the general nature of a thrashing machine. Some dealers object to machine-picked nuts, but the experience of those who follow that practice in harvesting their crops shows but little if any difference in the price of hand or machine detached pods of the North Carolina variety, and what difference there may be in price is offset by the saving in cost and the rapidity with which they can be put upon the market at any desired time. Besides, it is claimed that the hay, after passing through the picker or thrashing machine, is in better condition for fodder than the hay from the hand-gathered peanuts.

After the peanuts are picked they should be cleaned before being sacked. The necessity of cleaning is of course not so great as it was prior to the establishment of recleaners or factories, but still the cleaning of the nut would not only leave a large number of pops and saps on the farm for the feeding of stock, but would doubtless cause the nuts to bring a price sufficient to justify the expense of cleaning. The sacks used for peanuts are either 66 or 72 inches long, and wide enough to hold 4 bushels, or 100 pounds. Even should the farmer not intend to sell his nuts at once, he should at least sack them, as an attempt to keep them in bulk might cause them to heat. In filling the sacks care must be taken to fill each corner, and the entire sack should be well distended, yet not tight enough to crush the shells. Put away in a dry, airy place, peanuts will keep in these sacks several years, should it be necessary so to do.

Yield.—According to the Eleventh Census (Bulletin No. 378, p. 9), the average yield of peanuts in the United States in 1889 was 17.6 bushels per acre, the average in Virginia being about 20 and in Tennessee 32 bushels per acre. This appears to be a very low average, especially as official and semiofficial figures give 50 or 60 bushels as an average crop, and 100 bushels is not an uncommon yield. Fair peanut land properly manured and treated to intelligent rotation of crops should produce in an ordinary season a yield of 50 bushels to the acre and from 1 to 2 tons of excellent hay. Of course better land with more liberal treatment and a favorable season will produce heavier crops, the reverse being true of lands which have been frequently planted with peanuts without either manuring or rotation of crops. Besides the amount of peas gathered there are always large quantities left in the

ground which have escaped the gathering, and on these the planter turns his herd of hogs, so that there is no waste of any part of the plant.

The yearly production of peanuts in this country is about 4,000,000 bushels of 22 pounds, Virginia, Georgia, Tennessee, and North Carolina being, according to the Eleventh Census, the largest producers in the order named. These 4,000,000 bushels, while fully supplying the present demand in the United States, constitute but a small portion of the peanut crop of the world, as the exportation from Africa and India to Europe in 1892 amounted to nearly 400,000,000 pounds, Marseilles taking 222,000,000 pounds, most of which were converted into oil. The peanut crop of the world may be safely estimated as at least 600,000,000 pounds.

Preparation for market.—Since the establishment of peanut factories, or "recleaners," in nearly every community in which much attention is paid to this crop, the planter has ceased to especially prepare his nuts for market, selling them as "farmers' stock" to those factories or recleaners, where they are subjected to a treatment of fanning, polishing, and sorting before being put upon the market. This process is simple and inexpensive.

The machinery, neither costly nor intricate, is placed in a four-story building in such a way that the peanuts are not handled from the time they are put in their uncleaned condition in the hoppers on the fourth floor until on the first floor they are sewed in bags, branded, and marked ready to ship, with the exception that in the course of this process they have passed over a movable table in the form of an endless belt, between two rows of operators somewhat skilled in the detection of immature and faulty nuts, which are picked out and put into a separate receptacle, only the good and merchantable nuts being allowed to pass into the bag beneath; these are the hand-picked "factory stock" of the trade.

USES.

In describing the uses of peanuts it is scarcely necessary to more than refer to that use to which fully three-fourths of the American-raised crop is devoted. The nut is sorted in the factory into four grades, the first, second, and third being sold to venders of the roasted peanut, either directly or through jobbing houses. The fourth grade, after passing through a seller, is sold to confectioners, to be used in the making of "burnt almonds," peanut candy, and cheaper grades of chocolates. The extent of the use of the peanut by the American people will be more fully appreciated when it is remembered that they use 4,000,000 bushels of nuts yearly (at a cost to the consumers of $10,000,000), which do not form a part of the regular articles of food, but are eaten at odd times.

The nut is used by the planter as a fattener for his hogs, and reference to the analyses of the plant (table, p. 5) will at once indicate

its value for that purpose. The planter also makes use of the vine under the name of peanut hay, which is carefully saved and fed to all kinds of live stock, furnishing the best and cheapest hay to be found in the peanut section. The chief objection to it is that it is apt to contain considerable dirt, which may produce coughs in the animals eating it. It should therefore be fed from low troughs or mangers, and never from racks overhead. If frosted it may cause colic, but well-cured hay will not do this. If many immature pods are left on the vines, stock that is not worked much would need no other food during the winter. Care must be exercised, however, when beginning to feed it to horses, as there is danger of the saps or immature pods left on the vines foundering them if too much is fed at once. An analysis of this hay, as compared with hay from clover, timothy, cowpea, and alfalfa, is found in the following table, taken from Bulletin Volume IV No. 2 of the Tennessee Experiment Station:

Feeding value of peanut hay as compared with hay of other crops.

	Moisture.	Dry matter.				
		Protein.	Fats.	Carbohydrates.	Crude fiber.	Crude ash.
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
Peanut hay	7.83	11.75	1.84	46.95	22.11	17.04
Peanut vine	6.25	13.48	15.06	36.28	29.16	6.02
Clover hay	14.30	12.84	2.11	48.31	29.27	7.47
Timothy hay	13.50	7.17	1.97	52.94	33.41	4.51
Cowpea hay	10.29	19.72	4.04	45.15	21.99	9.10
Alfalfa	6.95	16.48	2.03	42.62	31.38	7.49

These analyses show peanut vines to be of high feeding value, comparing favorably in this respect with the most highly esteemed forage plants. When some of the nuts are cured and fed with the hay the feeding value is greatly increased, as the second analysis in this table shows.

These are uses to which the peanut crop is commonly put in this country, but it is not improbable that in the course of time the peanut may subserve other valuable ends here. Millions of bushels are being used in the countries of the Old World for the production of oil, in which the nuts are very rich. This oil is regarded as equal to olive oil, and may be employed for every purpose to which that is applied. This oil forms from 30 to 50 per cent (by weight) of the shelled nut; it has an agreeable taste and smell, and is more limpid than olive oil, which it very much resembles. Examinations of peanut oil manufactured in Tennessee show it to be very similar in character to cotton-seed oil and olive oil. It is sweet, palatable, and clear, and in fact great quantities are used, unknown to the consumer, instead of olive oil. To quote Consul Thomas, of Marseilles, in a report to the Department of State:

Much of it is used for eating purposes, both as a salad oil and in the composition of margarin. When made from a superior class of nuts, not too finely ground, the oil is said to be of fairly good flavor, and in the case of dearth of olives, might

serve as an excellent substitute for the more popular though possibly not more widely consumed extraction. Indeed, the people of all others best able to give an expert opinion as to the merits of peanut oil for table purposes, and who annually consume considerable quantities under the name of, and perhaps too faintly diluted with, olive oil, reside in the United States.

In India, Europe, Brazil, and this country it is used medicinally in the place of olive oil, and it is also employed by manufacturers as a substitute for the latter in fulling cloth. As a lighting fluid it lasts a long time, but does not give as clear a light as other burning oils. It is a durable, nondrying oil of a light straw color, and it is for its oil that the nut is imported into Europe, many gallons being used in the manufacture of soap and as a lubricant in machine shops.

Consul-General Mason, of Frankfort, says:

Cold-pressed oil of the first pressing of African or the best American peanuts is used in Germany as salad oil and for various culinary purposes. It ranges in price (wholesale) from $14.75 to $26 per 100 kilograms (220 pounds), or approximately from 56 cents to $1 per gallon, which is far cheaper than any edible quality of olive oil that can be imported and sold in that country. The American peanut is larger, sweeter, and, when roasted, better flavored than any of the others, but its oil is of medium quality and ranks below the African, being worth about $15.50 per 100 kilograms, or 59 cents per gallon.

A practical treatise on animal and vegetable fats and oils, by W. T. Brannt (London, 1888), says:

The kernels yield from 38 to 45 per cent of oil. The first cold pressure yields 16 to 18 per cent of very fine table oil. The residue is then broken up, moistened with water, and again cold pressed, yielding 7 to 8 per cent more or less valuable oil used for table purposes and burning; the residue from this is heated and then pressed, giving 7 to 8 per cent more of oil unfit for table use, but used for soap and lubricating.

United States Consul Trail, at Marseilles, in a report on manufactures of vegetable oils, dated April 4, 1892, says, regarding the process in that city:

These nuts are subjected to two pressings, the seed first being triturated and then heated to between 70° and 80° C. The yield of oil from the first pressing is about 50 per cent of the seed crushed.

Whether oil extraction from peanuts will ever become an established industry in this country depends upon (1) whether sufficient quantities can be secured to keep the mills at work, and (2) whether peanuts can be raised at a price low enough to compete with the other oil seeds which already have control of this market. To the average peanut planter, who for the past few years has been told that the market is overstocked and the supply greater than the demand, the intimation that the supply is not large enough for almost any purpose would meet with small credence; but a moment's reflection and calculation of the amount of nuts necessary to supply the demands of a first-class oil mill would at once show how comparatively small is the average crop. At 50 tons per day, 300 tons a week, or 15,000 tons a year, as a requisite amount to supply one mill, we find that nearly the whole American

crop would be consumed by two mills. But under present conditions the mills could not pay the price demanded for primes or extra fine stock, therefore the part of the present crop which could be utilized in oil making would be limited to the amount of the third or fourth class stock produced, which would not supply one mill six months.

The question of prices is one which can be answered only by future improvement in the methods of culture, an increased production per acre, and the invention of more economical means of harvesting and handling the crop.

The most important secondary product of peanut-oil manufacture is the oil cake, or meal, which remains after the oil has been extracted by pressure. This sells for from $30 to $33 per ton in Germany, where it is used for feeding cattle and sheep. After all the oil which can be expressed has been secured there still remains considerable fatty matter in the cake, which, together with its other contents, makes a most valuable animal food.

An average of over 2,000 analyses collated by German authorities is shown on page 5. A recent analysis[1] of peanut cake furnished by an oil factory in Tennessee gave the following results: Water, 6.58 per cent; ash, 4.21 per cent; protein, 53.19 per cent; fiber, 3.75 per cent; nitrogen-free extract, 24.01 per cent, and fat, 53.19 per cent. This shows a nutritive value for the American product somewhat superior to the German average.

Dietrich and König give the average coefficient of digestibility of this cake as follows: Protein, 90.24; fats, 85.66; nitrogen-free extract, 92.87.

An experiment was made at the Woburn Experimental Farm, in England, to compare peanut cake at $40.72 a ton with bean meal at $45.80, for steers. Each was fed in a grain ration with equal parts of oats and barley, and the animals received besides 45 pounds of roots and 15 pounds of clover-hay chaff per head. The trial lasted 107 days. The peanut cake proved to be a useful feeding material for cattle and to have a feeding value just about equal to that of beans.[2]

Dr. W. R. Robertson[3] in his experiments with peanut cake as a food for horses at the India farm, of which he was manager, found that 6 pounds of cake per day was sufficient to keep a horse in good working condition, and describes the method of feeding thus:

> The cake was broken into small pieces and steeped for twenty-four hours in cold water, just sufficient to make a stiffish paste. This paste is white and has a rather agreeable nut-like smell and taste; it is readily eaten by most horses.

In reference to its use as feed for other animals, Dr. Robertson says:

> I have used the cake very extensively in feeding working cattle; an allowance of 4 pounds per head per day, with forage, kept the animals in perfect health and con-

[1] Analysis made by the chemist of the Department of Agriculture.

[2] Royal Agricultural Society of England, No. 3, 1892, ser. 3, pp. 727–730.

[3] Jour. Roy. Agr. Soc. Eng., Vol. IV, Part III, 1893, p. 650.

dition. For fattening cattle I do not know of any better food, in regard alike to its feeding value and to the superior quality of the beef produced.

As a food for dairy cows it is admirable, both in increasing the yield of milk and in improving its quality. The butter of cows so fed is firmer and keeps much better than that of cows fed on any of the ordinary oil cakes. A daily allowance of 4 to 6 pounds of the cake, given in the form of paste, and mixed with 2 or 3 pounds of wheat bran, constitutes a perfect food for milch cows. I have had cows so fed for several years, yielding well and breeding regularly. For sheep there is no better food than earthnut cake, but for these animals I found it best to give the cake dry and broken into small pieces. I had a large flock fed on the cake for several years, and never knew any bad results attending its use. The ewes so fed bred regularly, milked well, and reared excellent lambs, while the mutton of these cake-fed sheep was of superior quality.

Many experiments have proved the value of the cake as a feed for pigs. For these animals it was usually made into a thin gruel and given mixed with bran. The same preparation, but in not quite so thin a condition, constitutes a superior food for fattening poultry. The flesh of poultry fatted on the cake is white, fine, and of superior quality.

From the above, and as a result of the various analyses, it can be concluded with certainty that the peanut cake is an excellent cattle food and can be made extremely valuable if judiciously mixed with other foods less rich in oil and nitrogenous constituents.

A grade of food for animals known as "peanut meal" is made by grinding the hulls, immature peanuts, and those of inferior grades, such as pops and saps, and a certain proportion of sound nuts mixed with other ingredients. This is carefully prepared, having all the dirt and foreign matter eliminated. The fiber is also to a large extent extracted, as well as the fluffy matter, and the meal is probably in a favorable condition for stock. The composition compares favorably with that of many foods now on the market. There is nothing in this preparation which can not be secured by the farmer himself without any expense, if he will take ordinary care in separating his marketable peas from the refuse stock before selling, which latter would be a valuable addition to the somewhat meager supply of winter fodder ordinarily provided by the farmers in the South for stock other than their work animals.

Although the experiment made with peanut meal and biscuits as food for the German army was not so successful as to induce the authorities to adopt it as a part of the rations, still analysis has shown conclusively that it is a most nourishing food for man, and as compared with other well-known forms of vegetable and animal food it has a high nutritive value.

During the years between 1861 and 1865, peanut oil was manufactured by at least four mills in the Southern States, and used as a lubricant by railroads for locomotives, by wool and cotton spinners for their spindles, and by housewives instead of lard as shortening in bread and pastry. The cake was eaten by many living in the vicinity of the mills, and was very highly spoken of by those who used it, as a palatable and nutritious food for man.

The following is a comparison made by Professor König, based on the price in Germany of the following twelve principal foods reduced to "units of nutrition:"

Comparison of the nutritive value and cost of twelve principal foods.

	Nutritive units per pound.	Cost per 1,000 units in cents.
Skim milk	98.2	10.4
Skim-milk cheese	870.0	11.0
Full milk	145.5	11.5
Bacon	1,257.7	15.5
Butter	1,186.3	20.4
Veal	525.9	22.2
Beef	530.9	26.0
Peas	778.6	4.2
Potatoes	138.2	5.1
Rye flour	603.6	6.0
Rice	534.6	10.0
Peanut meal	1,425.0	3.0

It follows, therefore, that peanut meal is not only the most nutritious, but by far the cheapest of this whole list of food materials.

SUMMARY.

(1) The peanut is a native of Brazil, but early after the discovery of that country it was introduced into Africa and other tropical parts of the Old World, where it became a staple article of food. It was only in the second half of this century that it became an important crop in this country.

(2) The varieties grown are the Virginia, running and bunch; the Tennessee and Georgia, white and red; the North Carolina, and the Spanish. The Virginia varieties, being most widely known and popular with the trade, are the ones commonly planted. There is little difference between the Virginia and Tennessee nuts, both being sold as "Virginia hand-picked" peanuts.

The Spanish nut has a small kernel of fine quality, and is in demand as "confectioners' stock," being worth several cents per pound more than any other shelled stock.

(3) The climate of the Atlantic Seaboard and Mississippi Valley has proven very congenial to this plant, which needs an early and warm spring, followed by a hot and moist summer, with but little rain in the harvesting season to injure the mature crop.

(4) While an open sandy soil which does not stain the shell is the ideal one for the peanut, it thrives on any friable soil that contains a sufficient quantity of lime and humus. The presence of lime is necessary for the development of the nuts, as without lime there may be luxuriant vines bearing nothing but pops. If the soil does not already contain lime in sufficient quantities the deficiency must be supplied by the use of some form of commercial lime, such as burnt oyster shells, burnt limestone, or marl.

(5) The peanut plant draws a large part of its nitrogen from the air, but it draws a considerable amount of phosphoric acid and potash from the soil. If the entire plant is removed from the soil, the crop becomes an exhausting one, and the fertility of the soil must be restored by the use of manures and rotation of crops.

(6) Peanuts should be planted in well-pulverized soil to a depth of 4 inches. The distance between the rows should be from 28 to 36 inches, varying with the fertility of the soil and the variety. Fertilizers should be applied broadcast before planting, but they may be applied in the rows, and at the time of planting. Carefully shelled and selected kernels should be used for seed. The seeds should be planted from 12 to 20 inches apart, two to the hill, and covered about an inch deep, either with a hoe or a small turn plow. All grass and weeds must be kept out of the field, and the soil kept loose and open, that the tender "spikes" may meet with no resistance in penetrating the ground. Experiment has not shown any definite results favoring either the ridge or level culture, and the nature of the field selected for the crop will be the best guide as to the method to be adopted. The crop should be laid by in July, or as soon as the vines have spread sufficiently to keep down the weeds, or to make the passage of the harrow between the rows dangerous to the developing pods.

(7) In harvesting the crop, the practice is to pass down each side of the row with a plow, made especially for the purpose, without a moldboard, and with a "sword," or long cutting flanges welded to the point. The plow is run deep enough to sever the taproot, without disturbing the pods. The vines are then lifted from the ground with pitchforks, and placed in rows; they are afterwards stacked around short poles. Two weeks later the pods should be dry enough to be picked off. After picking the nuts are placed in bags, holding 4 bushels, and either stored away in dry, well-ventilated sheds, or at once sold to the "factories," where they are cleaned, sorted, sacked, and branded. They are then ready for the trade.

(8) The larger portion of the American crop is sold by street venders, but small amounts are used by confectioners, chocolate manufacturers, and for the manufacture of oil. Peanut oil is used for lubricating and soap making, and is a good substitute for olive oil for salads and other culinary purposes, and as a substitute for lard and cottolene and butter in cooking. The residue from oil making, known as "peanut cake," is a highly valued cattle food in the countries of Europe, and is also ground into fine flour and used as human food. It makes good soup, griddle cakes, muffins, etc., and is one of the most nutritive of foods. It has, however, not been sufficiently tested to make it certain that it will be useful as a regular article of diet. The vines when dried become a very nutritive hay, readily eaten by stock; but in feeding care must be taken lest it give them colic.

FARMERS' BULLETINS.

These bulletins are sent free of charge to any address upon application to the Secretary of Agriculture, Washington, D. C. Only the following are available:

No. 15. Some Destructive Potato Diseases: What They Are and How to Prevent Them. Pp. 8.
No. 16. Leguminous Plants for Green Manuring and for Feeding. Pp. 24.
No. 18. Forage Plants for the South. Pp. 30.
No. 19. Important Insecticides: Directions for Their Preparation and Use. Pp. 20.
No. 21. Barnyard Manure. Pp. 32.
No. 22. Feeding Farm Animals. Pp. 32.
No. 23. Foods: Nutritive Value and Cost. Pp. 32.
No. 24. Hog Cholera and Swine Plague. Pp. 16.
No. 25. Peanuts: Culture and Uses. Pp. 24.
No. 26. Sweet Potatoes: Culture and Uses. Pp. 30.
No. 27. Flax for Seed and Fiber. Pp. 16.
No. 28. Weeds; and How to Kill Them. Pp. 30.
No. 29. Souring of Milk, and Other Changes in Milk Products. Pp. 23.
No. 30. Grape Diseases on the Pacific Coast. Pp. 16.
No. 31. Alfalfa, or Lucern. Pp. 23.
No. 32. Silos and Silage. Pp. 31.
No. 33. Peach Growing for Market. Pp. 24.
No. 34. Meats: Composition and Cooking. Pp. 29.
No. 35. Potato Culture. Pp. 23.
No. 36. Cotton Seed and Its Products. Pp. 16.
No. 37. Kafir Corn: Characteristics, Culture, and Uses. Pp. 12.
No. 38. Spraying for Fruit Diseases. Pp. 12.
No. 39. Onion Culture. Pp. 31.
No. 40. Farm Drainage. Pp. 24.
No. 41. Fowls: Care and Feeding. Pp. 24.
No. 42. Facts About Milk. Pp. 29.
No. 43. Sewage Disposal on the Farm. Pp. 22.
No. 44. Commercial Fertilizers. Pp. 24.
No. 45. Some Insects Injurious to Stored Grain. Pp. 32.
No. 46. Irrigation in Humid Climates. Pp. 27.
No. 47. Insects Affecting the Cotton Plant. Pp. 32.
No. 48. The Manuring of Cotton. Pp. 16.
No. 49. Sheep Feeding. Pp. 24.
No. 50. Sorghum as a Forage Crop. Pp. 24.
No. 51. Standard Varieties of Chickens. Pp. 48.
No. 52. The Sugar Beet. Pp. 48.
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